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ABSTRACT

Twelve audio-tutorial stations were used for teaching a general biology course. Cassette tapes were substituted for class lectures and helped integrate laboratory procedures with lectures. Slides, drawings, living and preserved materials, and a variety of chemical experiments supplemented the tapes. Behavioral objectives and exercises along with tapes and visual aids for each unit were given to students. The instructor met with small groups of students for two 1-hour periods each week. To evaluate the success of the audio-tutorial method, conventional biology course grades were predicted for each of the 18 students in the experimental group. The attained grades of this group were higher than the predictions. (MS)

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AN OBJECTIVE EVALUATION OF THE SUCCESS OF AUDIO-TUTORIAL COURSE IN GENERAL BIOLOGY

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There must be several hundred institutions of higher learning experiencing difficulty with students failing general biology courses. Schools having an open-door policy such as ours are especially prone to have high failure rates, due to the quality of the students we receive. For instance, for the past five years over 40% of our general biology students at Independence Community Junior College have made either a D or F.

This percentage of failures is frightening! One often wonders if students could learn biology more successfully if a technique other than the conventional lecture-lab course were employed. Also, if a new approach were successful, how could one objectively evaluate it?

CHOOSING AND IMPLEMENTING A NEW APPROACH:

We chose an audio-tutorial biology program in place of the traditional lecture-lab approach, because the A-T program emphasized individual learning and allowed for a closer relationship between instructor and students.

Twelve individual stations were set up on conventional laboratory tables. The program for each topic was recorded on cassette tapes and played on Wallensak recorder units. No more than 20 minutes of lecture-programming per tape were recorded for each topic. The tapes substituted for class lectures and in addition were used to integrate laboratory procedures with the lecture.

Transparancies, 35mm slides, single concept films, microscopic slides, and pictorial drawings were programmed

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in each tape to enhance better understanding of concepts taught. Living and preserved materials, and a variety of chemical experiments were also used to augment the tape on the explanation of a concept.

Behavorial objectives and exercises were given to students along with tapes and visual aids for each unit to be studied. The instructor met with small groups of students for two one-hour periods per week in order that all behavorial objectives are clearly understood.

In order to decrease variables between the conventional and A-T courses, the same teaching concepts were used, the same type of tests were given, and the same amount of time in class per week was allotted each student.

EVALUATION OF A-T COURSE:

Prior to setting up an audio-tutorial course much thought went into developing a systematic effective objective evaluation program. Too often one hears an instructor evaluate his A-T course in the following manner, "I feel that the A-T approach resulted in greater student motivation and learning". Also, one often finds that instructors compare results of grades between conventional and A-T programs. Since students in the A-T classes make better grades it is surmised that this approach is more effective. However, one would often wonder about the variation of innate abilities of the students in conventional and A-T classes.

Theoretically, it seems possible to evaluate a new teaching technique on the predicted grades that students should achieve based on past experiences. The success of a grade prediction evaluation method is contingent upon the teacher of the conventional course implementing an A-T course at the same institution. Also, there must be a valid correlation found for students in order to base a grade prediction. In our institution these criteria were no problem, because the biology instructor had taught conventional general biology for five years prior to the implementation of

an A-T program. Also, sufficient data on students were available so that a correlation of students' past experiences and actual grades achieved would be utilized toward developing grade predictions in future conventional classes.

Computerized student grade predictions for conventional biology students were not known by the A-T biology instructor until the semester grades were recorded.

SELECTION OF STUDENTS FOR A-T PROGRAM:

The prediction of a conventional biology course grade for each of the 18 students selected was based on the computerized regression formulae of Table 1 below, as determined by using the high school biology grades, the ACT composite scores, and the college biology grades of a group of 237 former students who had taken conventional general biology lecture-lab classes over the past five-year period.

TABLE 1

Regression formulae based on:	High school grades, ACT composite scores, and College biology grades.
(130) Boys:	G = -2.86787 + .31163C + .31435H
(107) Girls:	G = -4.28836 + .31459C + .59915H
	G = predicted regression score (equated to a letter grade level as explained below) C = ACT composite score H = high school biology grade, A=9, B=7, C=5, D=3, F=1.

The 18 students in the experimental group were selected from 169 second semester enrollees who had not previously taken general biology in college. There were 112 boys and 57 girls. A predictive regression score was calculated for each student through the respective formulae in Table 1.

Since 55 out of 130 boys in the former student group received D or F grades (42.3%), this same percentage of 112 boys, 47 of the enrollee group were considered as "predicted to attain below average grades." Likewise, since 36 out of 107 girls in the former student group received D or F grades (33.5%), this percentage of the 57 possible girl enrollees with the lowest calculated scores, 19, were also predicted to attain below average grades in conventional biology.

Using the highest score of the 47 boys and also the highest score of the 19 girls as guides, the predictive C level was established for the experimental group at the regression score of 4.32000 for boys and a regression score of 4.31000 for girls. The predicted scores of the 18 students who enrolled in the A-T biology course ranged from 2.13182 to 5.25372. Three of these were predicted to attain D or F grades.

COMPARISON AND CONCLUSION:

The predicted grades of the 18 students were utilized as data for expected letter grade frequencies in a chi-square distribution experiment. The actual course grades attained by the 18 students were utilized as the data for observed letter grade frequencies.

A comparison of these frequencies using Table 2 was made to determine a value of chi-square adjusted for 1 degree of freedom.

On the basis of the 0.1% level of significance with 1 d.f., $X^2=6.64$. Consequently we can say that the changes in the grade categories 99% of the time would not occur by chance. In fact, with a calculated $X^2=44.10$ and 1 d.f. these grade results would not occur by chance in 1 out of 1000 trials and more. Since it is so highly improbable that these results occurred by chance, we have attributed them to the different method of instruction--the A-T approach.

TABLE 2

Chi-square adjusted for one degree of freedom

Grade	(attained) o	(predicted) e	$\lvert o-e \rvert - \frac{1}{2}$	$(\lvert o-e \rvert - \frac{1}{2})^2$	$(\lvert o-e \rvert - \frac{1}{2})^2/e$
≥C	14	3	10.5	110.25	36.75
D-F	4	15	10.5	110.25	7.35
	18	18			$\chi^2 = 44.10$ (calculated)

The instructor who taught the A-T approach also taught concurrently a conventional control group of 18 students. Data was available for only nine of these students. According to the grade predictions as established not one student of the nine made a grade that was lower than expected. The instructor was unaware of any grade prediction for these students prior to the time when grades were recorded.

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